



Water poverty in the peri-urban territories of Mumbai, India

Anastasia Angueletou

► To cite this version:

Anastasia Angueletou. Water poverty in the peri-urban territories of Mumbai, India. Conference "The multidimensions of urban poverty in India", IGIDR, Indira Ganghi Institute of Development Research, CSH, Centre de Sciences Humaines, Mumbai, 6-7 octobre 2006, Oct 2006, Mumbai, India. halshs-00186276

HAL Id: halshs-00186276

<https://shs.hal.science/halshs-00186276>

Submitted on 13 Nov 2007

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

WATER POVERTY IN THE PERI-URBAN TERRITORIES OF MUMBAI, INDIA

Anastasia Angueletou
Ph.D. student in economics

LEPII, Laboratoire d'Economie de la Production et de l'Integration
Internationale, Grenoble
CSH, Centre de Sciences Humaines, New Delhi
anastasia.angueletou@upmf-grenoble.fr

Abstract

This paper addresses water poverty in the peri-urban areas of Mumbai¹. The term “water poverty” refers to a variety of situations where people lack from sufficient water in terms of quality and quantity or from enough money to buy water from formal and informal providers. The aim of this paper is to identify “water poor peri-urban population” and examine their access to water and how they satisfy their needs. Peri-urban areas are undergoing rapid transformations in the form of economic development, urbanization, demographic changes, environmental hazards all of which are having implications on the demand and supply of water. The water policies are not able to adapt to these rapid transformations. Therefore, a growing population lacks from sufficient access to water, in terms of being supplied by a large distribution network, or by private operators using alternative means.

Introduction

This paper addresses “water poverty” in the peri-urban areas of Mumbai. Its aim is to identify the “water poor peri-urban population” and examine their access to water and how they satisfy their needs. The term “water poverty” refers to a variety of situations where people lack from sufficient water in terms of quality and quantity or from enough money to buy water from formal and informal providers.

Peri-urban areas are undergoing rapid transformations in the form of economic development, urbanization, demographic changes, environmental hazards all of which are having implications on the demand and supply of water. The water policies are not able to adapt to these rapid transformations and water supply falls short of present and future requirements in peri-urban areas. Therefore, a growing population lacks from sufficient access to water, in terms of being supplied by a large distribution network, or by private operators using alternative means.

The importance of considering water supply in these territories arise from the fact that these areas are a support of social, economic, environmental and institutional interactions between urban and rural areas. Peri-urban areas are associated at the same time with both rural and urban features and consist of highly heterogeneous and rapidly changing socio-economic groups. Small farmers, informal settlers, industrial entrepreneurs and urban middle-class households may co-exist in the same territory, but with different and often competing interests, practices and perceptions. The water needs and demands of local population and

¹ A fireld work has been conducted in the peri-urban areas of Mumbai (Vasai-Virar Sub-Region, Kalyan Municipal Corporation, Panvel Town) from january to october 2005. This work has been financed from the French Ministry of Foreign Affaires and the Centre de Sciences Humaines in New Delhi.

services of water suppliers (formal and informal) are quite diverse and change over time. The identification of these needs is complex due to particular mix of newcomers and long established dwellers, and also because conflicting land uses (farming, residential and industrial) often co-exist.

Also, peri-urban areas often share the territory of more than one administrative unit. Weak links and limited municipal power in sectors such as water and land-use planning often result in uncertainty as to which institution administers which specific area or activity. The area is marked by a fragmentation of actors involved in the different stages, often with little coordination and articulation within a wide range of practices for accessing water.

The aim of the paper is to have a better understanding about water poverty phenomenon. It is structured in three main parts. In the first section we will present current definitions of water poverty. In the second part we will dress some features in order to better understand water poverty and in the last part we will develop the compensatory strategies of households in order to cope with water poverty.

Part 1 - Definitions concerning « water poverty »

The main question of this paper is: What is « water poverty » and how should we define it? Different definitions exist in order to explain or characterize water poverty. They have a quantitative, qualitative or an infrastructure point of view. Starting point for the construction of our definition is the notion of poverty in general.

The definition of “poor” may have quantitative or qualitative features. Quantitative measures describe those « below the poverty line » variously defined by individual country measures or internationally as those living with less than \$1 per day. Qualitative measures include « poor quality of life combining low income, poor health and education, deprivation in knowledge and communications, and the inability to exercise human and political rights» (ADB, 1999). Most definitions associate poverty with « lack » or « deficiency » of the necessities required for human survival and welfare. However there is no consensus about what basic human needs are. This will be our starting point in order to build the notion of “water poverty”.

One of the main challenges of the United Nations Millennium Development Goals is to halve the proportion of population without access to clean water and sanitation by 2015. But what does this statement really stand for? Who do we consider without access to water supply? Is it a lack of infrastructure in access to water? Is it a quantitative or qualitative lack of water?

First attempt to define water poverty is by observing the level of satisfaction of national standards about the minimum amount of water a person needs. In the peri-urban territories of Mumbai, in Vasai-Virar Sub-Region (VVSr), the Indian norm of 70 lpcd² is not always met. As the study shows, official water supply is even lower than this level and the household survey indicates an average of 40 lpcd of supply³. National standards should be examined and understood within the framework of specific local circumstances, as they have a big impact on how and whom is considered to be water poor.

Second quantitative definition of water poverty may be the level of “water stress” (Falkenmark, 1995). Malin Falkenmark developed the concepts of water stress and water

² 70 litres per capita per day is the Indian norm for water supply in small and medium towns without sewage system.

³ The household survey indicates a daily consumption of 40 lpcd, for all sources of water.

scarcity based on an index of per capita freshwater needs. She estimated a minimum need of 100 lpcd for household use. A country is said to experience water stress when annual water supplies drop below 1,700 m³/pers. At levels between 1,700 and 1,000 m³/pers, periodic or limited water shortages can be expected. When annual water supplies drop below 1,000 m³/pers, the country faces water scarcity.

These definitions associate « water poverty » with a « lack » or « deficiency » of water for human survival and welfare. However, there is no consensus about what basic water human needs are, as they depend on local circumstances. Needs are difficult to define in a standardized way. Water needs may vary considerably between rural, peri-urban and urban areas, and in a specific area between dwellers. The items which people regard as essential are influenced by culture and personal preference, and vary from individual to individual. So, water poor can not be reduced to the part of the population which does not have this quantitative access to water.

Another attempt, to identify water poor population, is to define who is considered as “no water poor”. It is common to use the criterion of “access to water”. There is a variety of definitions, which define “safe”, “adequate”, “appropriate” or “improved” access to water. Till 2000, WHO, UNICEF, WSP definitions referred to “safe access to water supply”. This assessment assumed that certain types of technology are safer or more adequate than others and that some of them could not be considered as “coverage”. The term “safe” is replaced (in 2000) with “improved” to accommodate these limitations. The population with access to “improved” water supply is considered covered (WHO/UNICEF, 2000).

- **Types of facilities considered as “improved water sources” are:**
Household connection, public standpipe, borehole, protected dug well, protected spring, rainwater collection within one kilometre of the home.
- **Types of technologies considered “not improved”:**
Unprotected wells, unprotected spring, vendor-provided water, bottled water, tanker truck provision of water.

Technology is used as an indicator of improved water, it provides informations regarding the existence of facilities. Like all indicators, it can allow only an approximate description of water coverage. The coverage figures produced by technology indicators do not provide information about the quantity, the quality of the water supplied or about its use. Furthermore, factors such as intermittence or disinfection could not be taken into account in the coverage figures (WHO/UNICEF 2000). So water poor population cannot be reduced just to the part of the population, which does not have infrastructure access to water.

Scholars (Franceys 2001) criticize the WHO/UNICEF definition of « improved », as concerns the potential quantity of supplied water, not the quality. His idea is that the goal for water is to have a potable supply available at every dwelling to meet public health needs – that is approximately 20 to 30 lpcd. The opportunity to purchase additional water for convenience benefits above this amount should be also available. The means by which this water arrives can be through a piped connection, delivering direct to a tap or via a storage tank to minimize peak loads on the pipes. We can also criticize this definition, even if it reflects the willing of a lot of households. The criticism is in the fact that it insinuates the reduction of the public service providing from the community and an unequal service between households.

These standardize definitions are only a partially and limited view of water poverty. They are useful to provide a uniform scale against which comparisons can be made. However, the standard of living of an individual or a household is a multi-dimensional concept involving, in principle, every aspect of direct consumption as well as non consumption activities and

services (Sen 1987). The requirement to judge each person using the same standard means that their individual definition of their own needs is subordinated. The « poor » are labelled as poor by outsiders, not according to their own criteria.

Water poverty includes a big variety of situations. It concerns poor population, without the financial capacity to get sufficient water in terms of quantity and quality in order to satisfy their needs. It is thought that this population can not afford the connexion to the municipal network, and satisfy its needs from alternative operators and sources of water. But water poverty does not affect only poor people⁴, it concerns also people with an insufficient or unsafe access to water in terms of quality and quantity. These people satisfy their needs combining more than one source of water. Depending the level or the type of water poverty a household will develop a specific coping strategy.

It is difficult to define how many people living in the peri-urban territories currently lack water and in which extent. It depends of the definitions and characteristics of water poverty. Field interviews with peri-urban dwellers provide some hints to advance a definition of the “peri-urban water poor”, in which the key feature are both formal and informal access to water, access to poor quality and quantity of water, scanner access to water and insufficient financial capacities of the household to get water (Allen, Davila, Hofman, 2006). Water poverty is at the same time, a pecuniary, a quantitative, and a qualitative problem of access. It depends of the satisfaction of water needs. Depending the needs unsatisfied, we could estimate different level of water poverty.

Part 2 - Examine access to water

2.1 - Access to water in the peri-urban territories of Mumbai

Originally water supplied in the North-West peri-urban areas of Mumbai⁵ was by wells and borewells, public and private. It is in the 80s that were installed the first kilometres of piped network. Since 1985 a local water policy and planification of the resource are established, as new water sources are mobilized. In the same time, conflicts in the use of water appear. Agriculture demand is opposed to household, commercial and new industrial demands.

It is estimated that the four towns get 15 MLD⁶ of water from wells and borewells, 15 MLD from tankers, and 25.5 MLD from the municipal network (individual, group connexion and standpost). Actually, a new water supply scheme⁷ is in progress in order to supply 100 MLD to the sub-region.

Universal coverage of the population as far as the water sector is concerned, is still an unmet goal.

According to official data in:

- Vasai town in a population of 49.346, 20.000 people are connected to the municipal network.
- Nallasopara, in a population of 184.538, around 150.000 are connected to the municipal network.

⁴ Poor in a pecuniary sense.

⁵ It is the Vasai-Virar Sub-Region: 380 km² and 4 towns: Vasai, Nallasopara, Navgar-Manikpur, Virar. With a total population of the sub-region of 6.22 lakhs in 2001.

⁶ MMRDA Data, 2005

⁷ The Surya Water Supply Scheme will provide 100 MLD to the 4 towns and 47 surroundings villages.

- Navghar-Manikpur, in a population of 116.700 people, municipality thing that around 110.000 are « connected ».
- Virar town the local authorities indicates a 100% of coverage of the population.

There are big differences in service access across towns and neighbourhoods in each town. Local authorities figures are estimations, as it is very difficult to have exact figures about the number of households “connected”, as the number of households sharing public taps and out door group connexions is only estimated. But, be connected to the network does not mean that people satisfy their needs. As the survey shows, a significant number of households have more than one source of water supply. So be connected to the municipal network is not sufficient to consider as household as “no water poor”.

Table 1: Formal and Informal water supply and Household consumption in the four towns

Town	Population 2001	Water Providers			Household Consumption
		Municipal Network		SCWP	Average lpcd (all sources)
		Supply MLD	Supply lpcd		
Vasai	49.346	2.5	100	wells & borewells, free water sources	30-50
Navghar-Manikpur	116.700	8.0	69	private tankers, wells & borewells, resellers, free water sources	30-40
Nallasopara	184.664	8.0	40	private tankers, wells & borewells, resellers, free water sources	40-50
Virar	118.945	7.0	55	wells & borewells, private tankers, free water sources	40-50

Sources: MJP 31/12/03. Data concerning household consumption are given from the survey of the author.

Although additional people gained access to services the recent years, field work interviews indicate that households can not meet their needs, and the demand – supply gap is growing. Projected urban population growth, in these areas, suggests that urban services will face great challenges over the coming decades to meet fast-growing needs.

Water supply service in VVSR has neither urban, nor rural water features. Because of a lack of planning, funds, political will, technical capabilities and managerial skills the service is not reliable. Informal providers (more or less well organised) supply water to the area. Households get water from small-scale water providers or free sources. In Vasai-Virar area, there are four types of water providers:

- Private tankers who sell water to building societies mostly in Nallasopara and Navghar-Manikpur. They supply the area since the mid 80s.
- The owners of wells, borewells and quarries. They use water for their own consumption or/and they sell it directly to their neighbours or to the tankers. These water sources are located in both urban and agricultural areas of the sub-region.

- The households « resellers » of municipal water. It concerns owners of houses and bungalows with individual water connexion, who sell water to the neighbours. Some households give or sell water exceptionally, but in some areas (near the slum areas) selling water is a very lucrative activity.
- The free sources of water: public wells and borewells, lakes, rain water. As the fieldwork showed, only few urban households depend completely from free sources of water. These sources may, but more often have no control from the municipalities.

2.2 - A better definition of access to water

In order to have a better understanding of water poverty, we will develop current definitions with more qualitative features. In order to understand “access to water”, we will be based on the opinions expressed from household interviews during the fieldwork, so as to define water poverty. We can dress a list of features that determine the existence and the level of water poverty:

- The presence of more than one source of water and a supply from both formal and informal providers.
- An inefficient supply both from the municipal network and alternative small-scale water providers:
 - quantity defaults: quantity of water available per person
 - quality defaults: quality of the service and supply available
 - service management problems: local water policies, frequency of the service
- Disponibility and control of the resource: existence of the source, distance from the source.
- Tariff structure.
- Household income.

Features of water poverty relevant to the municipal network

“Water poor population” is not a homogenous group. Big disparities exist in water access for peri-urban population between the four towns and in the different areas.

Municipal network can not be generalized, at least in a short term period. It is very segregatif and there is a minimum network developed, which creates excluded. This service can not satisfy completely present water needs. So, a first element which creates water poverty is the *accessibility or not to the piped network*. But, as we have seen earlier, be connected to the network is not a condition to be considered as “no water poor”.

Other features of water municipal service which creates water poverty:

- *Intermittence of the service*. According to the towns, supply lasts 15 minutes to 2 ½ hours per day, every alternative day or even less often.
- *Mis-management of the municipal network*. A water department not very well organised, with unskilled and few employees, which does not respect the time schedules of the supply, offer an irregular service⁸.
- *The type of settlements* and as a consequence, the *type of water connexion*: individual, group connexion, public tap, the *size of the connexion* (½”, ¾”). The access to water depends also from the *number of household* sharing the connexion and the *arrangements* between families. As each area of the town has to get a certain quota of water, for a certain period of time, the quantity of water a household gets depends from all these factors. For example in Navghar-Manikpur, water consumption estimated from the public taps is 30 lpcd, while water supply in bungalows and residential areas is 70 lpcd. Another

⁸ As the quantity of water supplied in each town is fixed, some areas will not get their daily quota.

feature of water poverty is the growing development of settlements outside existing formal regulations, affecting inhabitant's formal rights to basic needs.

- Even, if the four towns have the same source of water, they have different *tariff structures*. Few meter connexions exist. Water charges are fixed and depend on the diameter of the connexion. So, another type of disparity in water access is water tariffs. All poor or slum population do not benefit from social tariffs. For example in Nallasopara, a group connexion of ½'' for 12 to 16 apartments is charged 200Rs/month (12,5 to 16,7 Rs/month/household), an individual connexion for a bungalow is charged 200 Rs/month. For an hour, the municipality considers supplying 1.500 to 2.000 liters of water from a ½'' connexion. In this case, even if the price of the water remains the same 0,10 Rs/l, there is a big disparity in the quantity⁹ of water each household receives. In Virar, a ½'' group connexion for 12 apartments is charged 100 Rs/month and for a bungalow 100 Rs/month. The tariff structure indicates that there is an inequality between households in flats and bungalows, as the quantity supplied is not the same. So water is more expensive in Virar than in Nallasopara.

The survey indicates that both rich and poor people are affected from an irregular water supply, as well regularised and irregularised settlements suffers from an inadequate water supply. Because of the complexity and inefficiency of water supply from the municipalities, alternative water providers are developed in the area in order to satisfy the water needs of the peri-urban population.

Features of water poverty relevant to small-scale water provides

The activity of small-scale water providers is not uniform in the area, as they respond to specific local demands. The presence of these operators depends from the physical and temporary availability and accessibility of water, the location of the demand, the type of settlements, and financial means of households. As the fieldwork indicates, there is a big disparity in access to water from the alternative water providers, which influence the level of water poverty of the households.

- First level of disparity is the *disponibility of the source* in the territory. The availability of the resource will determine the quantity of water supplied. Significant part of the population depends on ground water. They get water from private wells and borewells as principal, secondary or seasonal sources of water. But, ground water access is very irregular and it is seasonally depended. As a result, disparities exist between towns and neighbourhoods of each town.
For example in Vasai, 30.000 people get water from private wells and borewells. They have access to a sufficient quantity of water through the year and of a very good quality. This population does not want to be connected to the municipal network. So, is this population considered to be « water poor »? The fact, that they are not connected to the municipal network, can not be the only condition to include them in this category. The willing to stay independent from the network is not general in the VVSR, as in other areas ground water and superficial water sources are seasonally depending.
- Other feature of water poverty is the *quality of water* of alternative providers. Households are very sensitive to this feature. The survey showed that people associate for each use a certain quantity and quality of water. For example, households are very keen to get at least 20-40 litres per day water of good quality for drinking and cooking. The good quality of water is very subjective, depending on the socio-economic structure of the households. People with no access to municipal network think that public service is of better quality. Other thought prevailing is that ground water and rainwater are « pure waters » as there

⁹ A household with a group connexion gets 125 to 166 l/day.

are resources in a natural state. Tankers sell water with no treatment or any quality control. So, depending the quality of water, a household will use it for cleaning, toilets, bathing.

- Other important feature concerning access to water from small-scale water providers is the *price of water*. Tankers' and resellers' water is very expensive. A tanker of 10.000 liters is charged 500 Rs¹⁰ (0,50 Rs/l). Households buying water from resellers get water 6/7 days and 20-40 l/day and they pay 50-70 Rs/month (0,10 Rs/l). Well and borewell water is less expensive as annual cost of maintenance does not exceed 100 Rs. The only cost we attribute to ground water is the electricity cost of the pump. But, we can attribute other indirect costs: treatment and purification costs, and costs related to the service: collection of water, travelling expenses.

Observing water supply from alternative operators in each town, we remark that suppliers present in an area and the type of service proposed is specific to each area, each neighbourhood. This multitude of local situations in water access from formal and informal water providers, reflect different levels of water poverty.

Because of water poverty, households have to develop coping strategies in order to satisfy their needs. Next section will present the compensatory strategies of VVSR households.

Part 3 - Household strategies to satisfy their needs

In order to cope with water poverty, households develop strategies to satisfy their needs. They either adapt to situation (reducing consumption, reusing of water, reschedule of household activities) or develop compensatory strategies, by diversifying the access to water and maximizing their capacity to get water (Zérah, 2000). The level, or type of water poverty, will induce the coping strategies of the households. The existence of these coping strategies shows both the extend of the phenomenon of water poverty and the unsatisfied demands. Because coping strategies induce costs, wealthy households can easier remedy from water poverty or rich a lower level of water poverty.

A central question is, if these strategies are a real choice for the household or if they are constraint to adopt them. The survey showed that households may adopt more than one coping strategy. Given the relations between geographic location and availability of water, one can assume that people's behaviour varies according to the zones and inhabitants of some area rely on larger panoply of strategies.

The survey indicates that the household proceed to the hierarchy of their needs according the necessary quantity and quality for each use. They identify the type of source, the quantity and quality necessarily for each consumption:

- Water for drinking and cooking
- Water for bathing
- Water for cleaning (utensils, laundry, cleaning the house)
- Water for toilets
- Water for garden

And then, for each consumption, they define their capacity of payment.

For example, number of household in Navghar-Manikpur use municipal water for drinking and cooking, and then according to the available quantities they will use it for the other uses.

¹⁰ In summer season, where shortage problems appear the price can double, with a unit price of 1 Rs/l.

Coping strategies of peri-urban households in VVSR

In Vasai-Virar Sub-Region, we have identified eight types of coping strategies:

- *Selection strategies.* The household will identify the operators and sources of water available in the area and will make a choice. Often, it is not a real choice, as alternative water supply solutions are very located and usually only one or two are available. The shortage of alternative operators is aggravated as the choice depends also from the financial capacity of the household.
- *Storage strategy.* Storage of water is a dominant strategy. It is adopted from the households in order to remedy to the intermittent supply and irregularity of the service. It may be a daily, frequent or seasonally strategy. Most of the times households store their daily consumption of water. As 24/7 water supply do not exist in this area, storage may even not be considered as a coping behaviour for households. It is considered as a coping strategy, when the member of the household responsible for storing, has to remedy to another activity in order to do so.

There are significant differences in the storage capacity of the households, because of the zone and type of settlements¹¹. Storing water may be in a reservoir (inside or outside of the house) or in buckets and drums. Survey showed that the quality of water stored depends on the equipment. The storage may be automatically (electric pump), or one or more members of the household be responsible for. The use of motor pump installed on the main water line and pumping water in the hours of supply is very marginal.

- *Pumping strategy.* Pumping strategies concern households with access to ground water. It may be public or private sources. In private wells, an electric pump may be connected to the source. The survey indicates that women and children are responsible to fetch water. Pumping activity may be very long and painful. When a source is shared from a group of households, rules exist for the priority to the source, the quantity fetched or the time spent. In some extent, the difficulties of water supply in VVSR are compensated by the availability of ground water. In the long term however, this is not sustainable due to the rapid decline of the water table. Monitoring is insufficient in order to certify the quality and quantity available. Households are already affected due to the drying up of their wells and they have to bear the additional costs of digging deeper. Over the last few years, many wells and borewells of VVSR are already dry in the beginning of summer season.

An important feature about access to water from ground sources, is the fact that new constructions of VVSR can either be connected to the municipal network, either get ground water. It is required a study from GWSDA¹² which certifies the existence of sufficient water through all year. This fact shows a decrease in the sense of public service, and may be considered as a feature of water poverty as ground water is not sufficiently controlled, in order to certify the regularity of the service.

- *Collection strategies.* Households collect water from outdoor connexions, public taps, wells and borewells, resellers, free open sources and rainwater¹³. It may be daily, frequently (many times per week or per month) or seasonally strategy of access to the source. This strategy takes up time and there is a physical limit to the water that can be carried. This water may be free or may be charged. For each access to water, we identify the quantity of water, the frequency of supply for each resource and the rules between households to share it.

¹¹ Settlements are grouped in 3 categories: houses and bungalows, buildings and chawls, slum.

¹² GWSDA: Ground Water Survey and Development Authority.

¹³ Rain water is a seasonal alternative access to water. People collecting rain water consider to have abundant free water of good quality.

- *Purchase strategies.* Households buy water from private tankers, resellers, private wells and borewells. The frequency may be daily, several times per week or per month, or seasonally and the choice of source depends from the needs to satisfy. For example, households buy water from resellers, around 20-40 litres per day and per family, in order to get a certain daily quantity for drinking and cooking. For the rest of their needs, people require a bigger quantity of water, less expensive. If they have the possibility to get water from a well or a borewell it is preferable, as the price is low and usually of better quality than tankers water. There are only few areas of VVSR which get tanker's water in daily use. Tankers supply mostly housing societies of middle and upper class. Their supply is more developed during summer, where there is a municipal shortage and ground water sources go dry.
- *Treatment strategies.* Water treatment strategy is in direct response to the problem of quality. Both waters from formal and informal supply are treated. A big majority of the population boils water and almost all households questioned treat water in monsoon season. Tankers' water is often of very bad quality. It is smelly, coloured, muddy and people avoid using it for drinking and cooking. The survey shows that income is an important factor for the choice of water treatment. Many households explained that they are compelled to have a certain treatment strategy, even if they know that it is not the safest. They make this choice because of a prohibited cost of others strategies. Survey indicates that the households are willing to pay more, in order to have a water of better quality.
- *Adaptation strategies.* Recycling and reschedule of activities is more a constraint than a choice. This strategy implies a shortage of water and somehow households have to take advantage of it. Even if water recycling is marginal, it is an important coping strategy in slum areas¹⁴.
Because of an irregular water supply, daily life of households is often organized around supply schedule, the time spent to fetch, carry water or store water. People have to get up earlier, return home earlier, stay awake till late at night, or even give up some of their activities¹⁵.
- *Exit strategies.* This is a more radical strategy. Few households declare willing to move out because of water problem and few have already done so. People tend to accept the water shortage and irregularity in the water supply, and develop more coping strategies in order to satisfy their needs.

Depending the level or type of water poverty and income, households will develop coping strategies which are more or less expensive. All households do not have the capacity to adopt the same strategies, as the cost of each strategy is not the same. It's the cost in order to improve access to water and reduce water poverty. The cost of compensatory strategies includes both monetary and time opportunity costs. The monetary cost comprises investments, operating charges (electricity), and maintenance (repairs and cleaning) costs for the eight strategies. The time opportunity cost is the monetary value of time by households in collecting water, queuing, pumping.

¹⁴ Mostly in Nallasopara

¹⁵ Young children do not go to school, as someone must stay at home or make the queue to fetch water.

Conclusion

This overview on water supply in the peri-urban territories of Mumbai points out a variety of water situations. Water poor population is not an homogeneous group, as they have different level of insatified demands. Small-scale water providers is an answer to insufficient water supply. Survey in VVSR indicates that neither households financial means, nor connexion to piped water are enough to satisfy water needs with an abundant ressource of good quality. As a consenquence of water poverty, we observe the commodification of water, which reproduise inequalities in the access on water and dissatisfaction of households demands.

Bibliography

- Allen (A.), Davila (J.D.), Hofmann (P.), 2006, Governance of water and sanitation services for the peri-urban poor. A Framework for understanding and action in metropolitan regions, UCL, DPU, p. 126.
- Allen (A.), 2003, "Environmental planning and management of the peri-urban interface: perspectives on an emerging field", *Environment&Urbanization*, vol 15, n° 1 pp. 135-148.
- Angueletou (A.), 2005, Les acteurs de l'eau des territoires péri-urbains Nord-Est de Mumbai : Role des opérateurs informels, International workshop Water poverty and social crisis, IRD, december, Morocco.
- Dupont (V.) (eds), 2005, *Peri-urban dynamics: population, habitat and environment on the peripheries of large indian metropolises*, CSH, Occasional Paper n°14.
- Franceys (R.), 2001, *Public-Private community partnerships in urban services for the poor*, ADB, p. 62.
- Iyer (R.R.), 2003, *Water: Perspectives, Issues, Concern*. Sage Publications, New Delhi, p. 368.
- Janakarajan (S.), 2004, « A snake in the grass ! Unequal power, unequal contracts and unexplained conflicts : Facilitating negotiations over water conflicts in peri-urban catchements », Draft version, Paper presented at the conference on Market Development of Water & Waste Technologies through environmental economics, 28th-29th may, Paris, MEED S.A., CERNA.
- Janakaranjan (S.), 2002, « Competition, conflicts and crisis. An example of degraded groundwater regimes and feckless governance in South India », Working Paper, Mandras Institute of Development Studies.
- Jhabvala (R.), Dudarshan (R.M.), Unni (J.) (eds), 2003, *Informal Economy centrestage, new structures of employment*, SAGE Publications, New Delhi, p. 290.
- Kundu (A.), Pradhan (B.K.), Subramanian (A.), 2002, « Dichotomy of continuum. Analysis of impact of urban centres on their periphery », *Economic and Political Weekly*, vol. 37, n°14, pp. 5039-5046.
- Llorente (M.), Zérah (M.H.), 2005, « Les enjeux d'eau en Inde. Des effets allocatifs et redistributifs complexes entre usagers et territoires », *Sciences de la Société*, n° 64, février 2005, pp. 175-193.
- Marris (S.) (eds), 2002, *India Infrastructure Report 2002, gouvernance issues for commercialisation*, Oxford University Press, New Delhi, p. 337.
- Raghupathi (U.), 2003, « Small private water providers. An alternative solution for the poor », *Shelter*, vol. 6, n°3.
- Pattanayak (S.K.), Yang (J-C), Whittington (D.), Kumar (K.C.B.), 2005, « Coping with unreliable public water supplies : averting expenditures by households in Kathmandu, Nepal », *Water Resources Research*, vol 41, W02012, doi :10.1029/2003WR002443.

- Snell (S.), 1998, *Water and sanitation services for the urban poor: small-scale providers : typology and profiles*, UNDP – World Bank, Water and Sanitation Program, dec. 1998, p. 59.
- Tovey (K.S.), 2002, The institutional responses to the water needs of the urban poor : a study of collective action in Delhi slums, India, A dissertation to the university of Cambridge for the degree of Doctor o Philosophy, June, p. 320.
- WSP South Asia, 2002, *Nouvelles formes de transactions pour l'eau et l'assainissement. La participation du secteur privé au profit des plus pauvres*, PPIAF, p. 67.
- WSP South Asia, 1999, *Willing to pay but unwilling to charge: do "willingness to pay" studies make a difference?*, Field Note, DFID, p. 8.
- World Development Report 2004, *Making Services Work for Poor People*, ESKA, p. 310
- World Bank Development Report 2000/2001, *Attacking Poverty*, ESKA, p. 381.
- WHO/UNICEF, 2000, Global Water Supply and Sanitation Assessment 2000 Report, p. 79.
- Wratten, E. (1995), Conceptualizing urban poverty, *Environment & Urbanization*, vol 7, n°1, pp 11- 22.
- Zerah (M-H.), 2006, "Urban water and waste water", in *India Infrastructure Report 2006*, pp. 130-159.
- Zerah (M.H.), 2000, *Water, unreliable supply in Delhi*, New Delhi, Manohar, CSH, p. 168.
- Zerah (M.H.), 1999, *L'accès à l'eau dans les villes indiennes*, Paris, Anthropos et Economica.

Fieldwork Data

- Census of India 2001, Maharashtra: Final Population Totals, (State, District, Tehsil and Town), series 28, Mumbai.
- Draft Regional Plan for Mumbai Metropolitan Region 1996-2011, (1995), Bombay Metropolitan Regional Development Authority.
- Development Plan of Vasai-Virar Sub-Region 2001-2021, Report, Committee appointed by Government of Maharashtra under section 162 of the M.R. and T.P. Act 1966.
- Modified Draft Development Plan of Vasai-Virar Sub-Region, Report 1998, CIDCO
- Draft Development Plan of Vasai-Virar sub-region, Report 1995, CIDCO.
- Interim Development Plan of VVSR, 1992, CIDCO.

Map: Mumbai Metropolitan Region

